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浙闽晚中生代辉绿岩脉的岩石成因: 年代学与地球化学制约

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摘要:

来自浙江文成和福建永泰两地的侵入于晚中生代中酸性火山岩地层中辉绿岩脉的形成于90~94Ma, 为晚白垩世岩石圈伸展作用产物。两地辉绿岩的SiO₂ = 48.61%~55.54%, Na₂O = 1.98%~3.89%, K₂O = 0.28%~2.26%, 为钙碱性系列; 岩浆在演化过程中经历了一定程度的镁铁质矿物、斜长石和副矿物的分离结晶作用。在微量元素特征上LILE (如Ba、Th)和LREE富集、HFSE亏损; 具有高放射成因Sr和低放射成因Nd同位素组成 (文成辉绿岩: $^{87}\text{Sr}/^{86}\text{Sr}(i) = 0.7080 \sim 0.7097$, $\epsilon_{\text{Nd}}(t) = -7.7 \sim -3.4$; 永泰辉绿岩: $^{87}\text{Sr}/^{86}\text{Sr}(i) = 0.7061 \sim 0.7062$, $\epsilon_{\text{Nd}}(t) = -1.2 \sim +0.5$), 明显不同于亏损软流圈来源岩浆。地壳混染/AFC、岩浆混合等过程不足以解释这些辉绿岩的元素-同位素变化特征。结合主、微量元素和Sr-Nd同位素组成, 我们认为区域晚中生代辉绿岩为伸展拉张背景下, 软流圈上涌与富集岩石圈地幔相互作用, 两种源区共同发生部分熔融的结果, 其中文成辉绿岩有更大比例的富集岩石圈组分参与, 而永泰辉绿岩的熔融源区中软流圈组分则更高。

英文摘要:

The diabases from Wencheng in Zhejiang Province and Yongtai in Fujian Province that intrude into the Late Mesozoic intermediate-felsic volcanic rocks in SE China were formed at 90~94Ma under an extensional setting. These rocks are calc-alkaline with a SiO₂ range of 48.61%~55.54%, a Na₂O range of 1.98%~3.89% and a K₂O range of 0.28%~2.26%. Fractional crystallization of predominant mafic minerals (e.g., olivine and pyroxene) and subordinate plagioclase and accessory minerals was responsible for the major and trace element variations. They are characterized by arc-like trace element features with large ion lithophile element (LILE, e.g., Ba and Th) and light REE (LREE) enrichments and high field strength element (HFSE) depletions and radiogenic Sr and nonradiogenic Nd isotopic compositions ($^{87}\text{Sr}/^{86}\text{Sr}(i) = 0.7080 \sim 0.7097$, $\epsilon_{\text{Nd}}(t) = -7.7 \sim -3.4$ for the Wencheng diabases; $^{87}\text{Sr}/^{86}\text{Sr}(i) = 0.7061 \sim 0.7062$, $\epsilon_{\text{Nd}}(t) = -1.2 \sim +0.5$ for the Yongtai diabases). All these features were quite different from those mafic magmas derived from asthenosphere. However, neither crustal contamination and/or assimilation via fractional crystallization nor magma mixing processes could well explain the observed elemental and isotopic variations in these rocks. By contrast, the combined geochemical data suggest that these diabases were formed through different proportional mixing between an enriched lithosphere component and the underlying asthenosphere under an extensional regime throughout the SE China continent. The Wencheng diabases with more evolved Sr-Nd isotopic compositions were derived from such a mixed source containing a higher proportion of enriched component, whereas the asthenosphere component was greater in the meltin g source for the Yongtai diabases to account for their less evolved Sr-Nd isotope signatures.

关键词: [地球化学](#) [岩石圈伸展](#) [辉绿岩](#) [晚中生代](#) [东南沿海](#)

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